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MANIPAL INSTITUTE OF TECHNOLOGY

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II SEMESTER M.TECH. (STRUCTURAL ENGINEERING)
END SEMESTER EXAMINATIONS, APRIL/MAY 2017
SUBJECT: ADVANCED PRESTRESSED CONCRETE [CIE 5252]
REVISED CREDIT SYSTEM

(22/04 /2017)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.
- *Use of 18:1343-2012,18:784-2001, Authorized Design Aid are permitted*

1A.	A post-tensioned beam of span 12 m has a rectangular section 300 mm wide and 900 mm deep. The beam is pre-stressed by a parabolic tendon concentric at the supports and with an eccentricity 300 mm at the centre of span. The cross-sectional area, A_p of uncoated stress-relieved strand (galvanized) in the tendon is 560 mm^2 and f_{pk} = 1570MPa. The tendon is stressed by using jack at the left end up to 75% of f_{pk}. Calculate a) the expected elongation of the tendon after stretching, b) loss due friction and wobble till mid span c) loss due to anchorage slip of 4 mm, assume E_s = 200000 MPa, Grade of concrete = M40, tendons are stretched simultaneously.	**5**
1B.	A bonded post-tensioned concrete beam has flanged -section: top flange 450 x 175mm, bottom flange 300 x 250 (depth) mm, web 140 x 550 depth mm. The beam is pre-stressed by tendons of area 1750 mm^2 located at 125 mm from the soffit (bottom surface) with an effective pre-stress of 1100 MPa. Tensile strength of tendon, f_{pk} is 860 MPa. Grade of concrete is M60. Estimate the ultimate flexural strength by the method of IS 1343- 2012.	**5**
2.	Design a Post-tensioned Type-I PSC continuous rectangular beam of two equal span, AB=10 m and BC = 10 m to carry a live load of 15 kN/m. The beam has to be casted using M-45 grade concrete and has to be pre-stressed using 9.5 mm 7-plystrand of nominal c/s area of strand is of 51.6 mm^2, having characteristic strength of 1465 N/mm^2. Take strength of concrete at transfer as $0.7f_ck$, and pre-stress in strand after transfer 970 N/mm^2. Assume 15% loss at service. Sketch the maximum and minimum eccentricities of the prestressing force at different locations along the span of beam. Check the section at mid-support for permissible stresses.	**10**
3.	A composite tee beam is made up of a pre-tensioned rib 330 mm thick and 1000 mm deep and a cast-in-situ slab of 200 mm thickness and 1200 mm width. The beam is simply supported over a of span 15 m to support an imposed load of 18 kN/m. Assume grade 40 concrete in precast web and slab and high strength wire of f_{pk} = 1470 MPa. Assume long term loss in cable as 15%. Design the composite section and shear connections. Compute stresses at the critical section at various stages. The precast member is unpropped during the casting of the CIP portion.	**10**

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4.	Design a simply supported pre-stressed post-tensioned (type 1) slab for the following data. Effective span = 7 m, grade of concrete = M40, Live load = 2 kN/mm^2. Floor finish = 1.5 kN/m^2, grade of high strength wire, f_{pk} = 1470 MPa (7 mm diameter). Assume long term losses as 15%. Check for deflection using creep coefficient as 1.6.	**10**
5A.	A non-cylindrical pre-stressed concrete pipe of internal diameter 1500 mm and length 4m, is required to with stand a working pressure of 1.6 N/mm^2. Design pipe thickness, and longitudinal and circumferential pre-stressing forces, spacing of wires. Assume circumferential winding by the process of counter weight/break. Use high tensile wire of 5 mm diameter ultimate strength 1570 N/mm^2 and M-40 grade concrete. Assume: i) minimum compressive stress under working load to be 1.0 N/mm^2, ii) coat thickness as 25 mm, iii) strength of concrete at winding 30 MPa and at Detensioning longitudinal 20 MPa, iv) bedding angle = 120° & θ = 180°. Calculate for circumferential pre-stressing requirement, i) stresses due to external load water weight, ii) stresses induced in core at factory test, iii) stresses in pipe core due to internal pressure at factory test.	**10**